

LLNL Environmental Restoration Division (ERD)
Standard Operating Procedure (SOP)

**ERD SOP 2.9: Sampling for Tritium
in Ground Water—Revision: 6**



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1.0 PURPOSE

The purpose of this SOP is to define the procedures for the collection of ground water samples for tritium analysis that are representative of the aquifer of interest.

2.0 APPLICATIONS

This procedure applies to the collection of water samples to be analyzed for tritium.

3.0 REFERENCES

- 3.1 Morse, S. I., P.E. (1997), San Francisco Bay Regional Water Quality Control Board, Toxics Cleanup Division; letter to Interested Parties. Subject: *Utilization of Non-Purge Approach for Sampling of Monitoring Wells Impacted by Petroleum Hydrocarbons, BTEX, and MTBE*, File: 1123.64, January 31, 1997.

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- 3.2 Robbins, G. A., and J. M. Martin-Hayden (1991), Mass Balance Evaluation of Monitoring Well Purging: Part 1. Theoretical Models and Implications for Representative Sampling,” *J. Contam. Hydrol.* 8, 203–224.
- 3.3 Schilling K. E. (1995), Low-Flow Purging Reduces Management of Contaminated Groundwater, *Environmental Protection*, December 1995.
- 3.4 Taffet, M., J. A. Oberdorfer, T. M. Carlsen, W. R. Dugan, and R. S. Mateik (1990), *Remedial Investigation of the Building 850/East Firing Area, Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-ID-104335).
- 3.5 U.S. Environmental Protection Agency (EPA) (1995), Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, *Ground Water Issue*, EPA/540/S-95/504.
- 3.6 U.S. Environmental Protection Agency (EPA) (1995), *Use of Low-Flow Methods for Ground Water Purging and Sampling: An Overview*, Quick Reference Advisory (December 1995).

4.0 DEFINITIONS

See SOP Glossary.

5.0 RESPONSIBILITIES

5.1 Division Leader

The Division Leader’s responsibility is to ensure that all activities performed by ERD at the Livermore Site and Site 300 are performed safely and comply with all pertinent regulations and procedures, and provide the necessary equipment and resources to accomplish the tasks described in this procedure.

5.2 Field Personnel

The field personnel are responsible for properly performing ground water tritium sampling in compliance with all applicable regulations and procedures.

5.3 Sampling Coordinator (SC)

The SC’s responsibility is to ensure that the field personnel comply with all pertinent SOPs related to routine tritium sampling.

6.0 PROCEDURE

6.1 Office Preparation

6.1.1 Prior to commencement of field activities, perform preparation activities described in SOP 4.1, “General Instructions for Field Personnel.” Personnel shall review the appropriate Site Safety Plan (SSP), and all applicable SOPs, Operational Safety Procedures (OSPs), and Integration Work Sheets (IWSs). Current copies of all appropriate documents shall be retained by the field personnel.

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- 6.1.2 Review all pertinent sampling information such as the quarterly Sampling Plan, Well Specification Table, and electronically generated Ground Water Sampling Data Sheets provided by the SC. The plan contains the following information:
 - Locations to be sampled.
 - Proposed sampling methods (See SOP 2.1, “Pre-sample Purging of Wells,” Attachment B, Methodology Sampling Codes).
 - Requested analyses.
 - Contract analytical laboratory (CAL) to which samples are to be sent for analyses.
 - Estimated amount of purge water to be collected, and where and how it will be treated.
 - Current technical information for each well.
- 6.1.3 Obtain appropriate data collection forms i.e., Chain-of-Custody (CoC) forms, Ground Water Sampling Data Sheets (SOP 2.1, Attachment C), assigned Document Control Logbook, labels, and any necessary shipping forms. Instructions for completing the logbook entries and field forms are provided in SOP 4.2, “Sampling Control and Documentation.”
- 6.1.4 The appropriate number and type of sample containers needed for the sampling event should be obtained from the sample bottle inventory. The type of analysis for which a sample is being collected determines the type of bottle, preservative, holding time, and filtering requirement. See SOP 4.3, “Sample Containers and Preservation.”
- 6.1.5 The appropriate personnel should keep a sufficient stock of sample containers and maintain an inventory of supplies (i.e., disposable 0.45µ fiber filters, trip blanks, field blank water ordered from the contract analytical laboratory [CAL], plastic bags, etc.) to ensure adequate sampling supplies are available at all times.

6.2 Field Preparation

- 6.2.1 Check with the Functional Area Supervisors for area access per SOP 4.1 and insure that permission for offroad travel has been granted, if applicable (SOP 4.1, “General Instruction for Field Personnel”). The Administrative Escort Services must be given a 24-hour notification before work is scheduled in restricted areas at Site 300.
- 6.2.2 Assemble all necessary supplies, packing materials, and appropriate sampling equipment. Load into the field sampling vehicle. Refer to Equipment Checklist (Attachment A).
- 6.2.3 Decontaminate any nondedicated equipment that will be used per SOP 4.5, “General Equipment Decontamination.”
- 6.2.4 Locate monitor wells to be sampled and choose most efficient sampling order. Sample from areas with the lowest tritium activity to the areas with the highest activity, if possible.
- 6.2.5 Fill out any initial information in the Document Control Logbook per instructions in SOP 4.2.

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6.3 Operation

If the well contains a dedicated bladder or electric submersible pump, only enough presample purging is done to remove all stagnant water residing in the discharge line of the pump. However, many of the monitor wells do not have dedicated purging/sampling equipment. For these wells, samples are collected using a manual bailer or by attaching a sample container to the probe of an electric water level indicator.

6.3.1 Sample Collection with Electric Submersible Pump or Bladder Pump

The collection of tritium samples using these two devices is consistent with that described in SOP 2.3, "Sampling Monitor Wells with Bladder and Electric Submersible Pumps." When using the electric submersible or bladder pump, purge the required volume of water prior to sample collection to remove stagnant water from the discharge line. Collect and treat water per SOP 4.7A, "Livermore Site Treatment and Disposal of Well Development and Well Purge Fluids," or SOP 4.7B, "Site 300 Treatment and Disposal of Well Development and Well Purge Fluids."

6.3.2 Sample Collection with Bailer

Manual bailing is described in SOP 2.4, "Sampling Monitor Wells with a Bailer." This procedure is generally followed in sampling for tritium in ground water, except that no presample well purging is necessary.

6.3.3 Sample Collection with Water Level Indicator

Attaching a 40 mL volatile organic analysis (VOA) vial to the probe of an electric water level indicator with a polyethylene cable tie is a simple means of sampling for tritium.

- A. Uncap and attach a clean sample container to the probe of the water level indicator using a polyethylene cable tie. The container should be attached about 3 to 4 in. from the tip of the probe if a water level measurement is to be obtained during sample collection (Refer to SOP 3.1, "Water-Level Measurements").
- B. Slowly lower the probe and sample container into the monitor well. Lower the container so it will fill completely, and then slowly reel the probe and container back to the surface.
- C. Detach the container from the water level probe and cap container. Clean the water level indicator as discussed in SOP 3.1.
- D. Immediately label the sample container, place into a air tight plastic bag, and store in a cooler (refer to SOP 4.3).
- E. Record all sampling information (e.g., well ID, method of collection, and date) per SOP 4.2, in the Document Control Logbook and Ground Water Sampling Data Sheet (SOP 2.1, Attachment C).

6.3.4 Tritium Sample Collection With a Specific-Depth Sampling Device

No pre-sample purge is required when using this device. The sample is taken from a specific portion of the screened interval (refer to SOP 2.6, 6.3.2 D, "Sample Retrieval—Specific-Depth Grab Sample Device").

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6.4 Post Field Operation

- 6.4.1 Perform post operation activities per SOP 4.1.
- 6.4.2 Before leaving the sampling location, verify that the appropriate samples have been collected according to the samples scheduled on the Ground Water Sampling Data Sheets.
- 6.4.3 Prior to sampling another site and to prevent cross contamination of equipment between locations, thoroughly decontaminate all equipment that is not dedicated according to SOP 4.5.
- 6.4.4 Complete the appropriate Ground Water Sampling Data Sheet and record sampling information in the assigned Document Control Logbook (SOPs 2.1 and 4.2).
- 6.4.5 Verify that the CoC is appropriately completed per SOP 4.2. Indicate any special instructions in the Remarks Section of the CoC. Such instructions may include a request for the laboratory to filter and preserve the sample upon receipt. Also, for wells that are listed on the sampling plan as Clean Wells or for any well that is expected to be free of contamination write, "Verify any positive detections and call _____." The blank should be filled in with the appropriate QC Chemist's name and phone number.
- 6.4.6 Deliver Ground Water Sampling Data Sheets and CoC forms to the SC daily. Hand carry or mail copies of the completed CoCs to the Technical Release Representative (TRR) daily.
- 6.4.7 The SC will retain a copy of the original forms (CoC, Ground Water Sampling Data Sheets), and provide the originals to the Data Management Team (DMT) for final archive. The SC will provide copies of the forms to the appropriate Operations and Regulatory Affairs Division Analyst, as necessary.
- 6.4.8 Leave routine samples and proper documentation in the environmental sample lock-box for the CAL. Field personnel will ship samples and/or distribute to the appropriate laboratories. Ensure that the samples requiring refrigeration remain at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$, but do not allow them to freeze. Always ensure that proper chain of custody is maintained.

7.0 QA RECORDS

- 7.1 Document Control Logbooks
- 7.2 Ground Water Sampling Data Sheets
- 7.3 Chain-of-Custody form

8.0 ATTACHMENTS

Attachment A—Equipment Checklist

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Attachment A

Equipment Checklist

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Equipment Checklist

- _____ Generator
- _____ Two-way radio
- _____ Water-level indicator
- _____ Indicator refence bar
- _____ Polyethylene cable ties
- _____ Ziploc-type bags
- _____ 40 mL VOA vials or other appropriate glass sample containers
- _____ Coolers
- _____ Deionized water
- _____ Document control logbook
- _____ Tool kit
- _____ Disposable latex gloves
- _____ Snake chaps (if necessary)
- _____ Squirt bottle
- _____ Detergent soap
- _____ Pencils, pens
- _____ Sample labels
- _____ Paper towels
- _____ Bailer/rope